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Vol. VII MARCH, 1927 No. 12

American Cinematographer

FOSTER GOSS, *Editor and General Manager*

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The EDITOR'S LENS • • focused by FOSTER GOSS

New Directors

APPROPOS of the observations of Daniel B. Clark, A.S.C. (printed in another part of this issue) concerning an interview with Jesse L. Lasky appearing in a national fan magazine relative to the fact that no cinematographers have been imported along with foreign directors, the supremacy of the American cinematographer in the world of cinema production once more is demonstrated.

¶ While there may have been any number of reasons as to why foreign directors and stars have been brought to this country, it may truthfully be said that the more prominent of these artists have been induced to come to the United States because they were without peers in their respective lines.

¶ Comparisons are odious, so instead of venturing that such directors were more able their American brethern who might have done the same type of work, let it be said that the newcomers have mastered a directorial field which had not existed in this country. If this premise be sound, can the same thing be said concerning the American cinematographer and his foreign counterpart? Mr. Lasky says no, and he is right. There is nothing in the cinematographic line of which the American camera artist is not the master. Unlike the directors, the foreign cinematographer has not arrived at something which had not existed in this country.

¶ Hence, foreign directors coming to Hollywood studios have American cinematographers. As Mr. Lasky points out, those with whom they worked beyond the seas have been left behind.

¶ Singularly enough, foreign directors, who have been imported because they "had something" not possessed in American production, are those who may be said to have a "cinematographer's mind." Consult the work of Murnau in "The Last Laugh," of Dupont in "Variety" and so on, and we believe that this truth will reveal itself.

¶ This brings us to the conclusion that if it takes some one with a "cinematographer's mind" to introduce new treatment and ideas into American made productions, why not turn to American cinematographers—admittedly the best in the world—for fresh directorial blood?

¶ There is a substantial number of well-known cinematographers who on this very day could step to the directorial chair and become outstanding entities. They are men who have been leaders in their own branch of the profession for many years. Not a few of them have been prominent at the camera since the earliest days of the business. There is not a one of them who, if the producer would give him the necessary freedom in the exercise of his own ideas, but who could turn out a picture as artistically startling and as commercially successful as anything produced in European studios to date. There is no better place to become thoroughly imbued with all that is good in direction than at the camera. The cinematographer is always at the side of the director—where the assistant director may be busy with the shoes; the scenarist, involved with his next script; and the cutter, in the midst of his preceding picture.

¶ It is needless to point out the former cinematographers who have made their mark as directors. Nor need it be said that there are some cinematographers who, in spite of the present-day emphasis which is laid on direction, would never desert the camera for any director's job. In fact, the latter is the attitude of too many cinematographers. Leaders in their own line, they have been forced to the conclusion that, if they did put up the required fight to get their hands on a megaphone in their own right, they would not be given the sway of their own ideas of directorial expression, but would be obliged to produce their material in established studio fashion.

¶ But our conclusion is the same—if some far-sighted producer wants to surprise himself and the rest of the picture universe, let him select some of the cinematographers who have served him so well and give them the opportunity to direct according to their own ideas.

"Talking Pictures"

DURING the barrage of questions fired at him on the occasion of the eightieth anniversary of his birth, Thomas A. Edison is quoted to have said that the future of motion pictures is "onward and upward," and, more specifically, that the current interest in talking films is something of a fad which will pass by in a time.

¶ Although Mr. Edison is not so actively interested in the cinema as he once was, it is safe to assume that the great inventor still knows whereof he speaks on a subject such as this. His own organization had ample experience with talking pictures, and doubtless he draws his answer from his own experiments in this direction.

¶ We believe that the contemporary interest in the talking motion picture is a wholesome thing, and certainly is a medium of good rather than harm Likewise with the interest in colored motion pictures, which, with the advent again of the auditory film, is not occupying the center of the cinematographically curious stage. We, however, are inclined to agree with Mr. Edison that the theatre-going public is well satisfied, as a general thing, with motion pictures in their now established form There will and must be improvements, but these can well come without radically altering this form.

¶ Making successful presentations of pictures accompanied by reproductions of the human voice in metropolitan cities and staging similar performances in hamlets and towns present a quite different situation. We do not say that such cannot be effectively

(Continued on Page 24)

PROJECTION • *Conducted by* EARL J. DENISON

Studios Need Good Projection

By Daniel B. Clark, A.S.C.

President *of* A.S.C. Says Studios, *as well as* Theatres Require Best Equipment

IN the January issue of the *American Cinematographer,* the writer recounted some of his experiences encountered when, during location trips, he visited small-town theatres and found, in many of them, worn-out systems of projection still in use.

Since writing the January article, it has dawned on him that the small-town amusement places are not the only ones which house antiquated projection apparatus.

In Hollywood

Strange as it may seem, the condition exists in Hollywood itself as well as in some of the meanest cow towns. And not in the theatres of Hollywood particularly—but in the *studios themselves!*

Projectors for Production

Perhaps it does not occur to many, outside the motion picture capital, just how many projectors are in use in Hollywood. Not so many theatres there as in New York City to be sure, but just pause a moment and think of the dozens of projectors which are a necessary part of the studios, laboratories and the private projection rooms, all of which are located in the motion picture city.

Passable Projection

It behooves me that in some of these Hollywood production quarters—studios included—that acute slip-shod projection is allowed to pass. The attitude, as nearly as I have been able to sift it down, is that the small audiences which view such projection is composed of experts and professionals in the cinema business, and that they, as such, are interested solely in action, direction, etc., all of which they are able to discern without too much regard to the projection.

Cinematographer's Interest

But right here is where the cinematographer comes in—most emphatically.

How many times hasn't he sat in the studio projection room, and heard aspersions cast, forcibly and otherwise, on the quality of the cinematography when the same grade of work was praised in one of the other projection rooms on the same lot?

Recipient of Blame

In the studio, when there is anything wrong with the kind of picture that is being thrown on the screen, there is, of course, only one person to blame—and that is the cinematographer! It is a fortunate knight of the camera indeed that has never had to undergo these tribulations!

Best Is Needed

In all seriousness, it seems to me that facilities in every projection room in the studios should be just as fine and as up-to-date as in the best theatres. Certainly, the studios, of all places, can afford to maintain such equipment. Unlike the small exhibitor, it is not in keeping for them to plead poverty in this respect. And many of them certainly do not, for their projection systems would be a credit any place. But, alas, what worn-out and sorely abused equipment is being imposed on in some quarters! No wonder that, in such places, a fair criterion can never be arrived at on the exhibition of their pictures. The solution is to have a fair testing ground in this respect so that the studio projection will be parallel with that which is attained when the finished picture goes ultimately into the better theatres.

A Testing Point

Thereupon the whole production staff can govern their work accordingly, the laboratory included. If an unsuitable kind of make-up is being applied, it can be changed to the type best suited to get a maximum appearance when the theatre print is finally exhibited before the public, and so on.

Yes, even more than theatres, studios need the best there is in projection.

In Cameraformia...

and News Notes of the Month

JOHN W. BOYLE, A.S.C., is photographing "Topsy and Eva," a Schenck production, starring Vivian and Rosetta Duncan. Del Lord is directing. The cast includes Gibson Gowland, Nils Aster, Imogene Robertson and Noble Johnston. Boyle will go to Lake Tahoe, California, for location scenes.

* * *

George Meehan, A.S.C., is filming "The Midnight Kangaroo" at the Fox studios.

King Gray, A.S.C., is shooting "Not the Type" at the Fox studios.

* * *

Georges Benoit, A.S.C., in association with Nicholas Musuraca, A.S.C., is filming "Belgrano," a feature production based on the fight for independence in the Argentine. Francis X. Bushman and Jacqueline Logan are starred. Al Kelley is directing.

* * *

Robert B. Kurrle, A.S.C., is hard at work on the cinematography in "The Tender Hour," a First National production, which, starring Ben Lyon and Billie Dove, is being directed by George Fitzmaurice.

* * *

David Abel, A.S.C., is filming "The First Auto" at the Warner Bros. studio. Roy Del Ruth is directing. Patsy Ruth Miller is starred.

* * *

Dan Clark, A.S.C., has reached the mid-point in the photography of "The Outlaw of Red River," starring Tom Mix. Lou Seiler is directing the Fox feature.

* * *

Victor Milner, A.S.C., is chief cinematographer on the first American production to star Emil Jannings, German star. Victor Fleming is directing the feature.

* * *

George Schneiderman, A.S.C., is photographing George O'Brien and Edmund Lowe in "Is Zat So?" the Fox production of the stage success.

* * *

Dev Jennings, A.S.C., is in the midst of the photographing of Buster Keaton's latest comedy.

* * *

Gaetano Gaudio, A.S.C., is chief cinematographer on "His Son," a Sam Rork production for First National. Lewis Stone is starred. John Francis Dillon is directing.

* * *

Joseph Brotherton, A.S.C., is finishing shooting "Blake of Scotland Yard" at Universal City.

* * *

Ross Fisher, A.S.C., is shooting "The Sunset Derby," a First National production, featuring Mary Astor and Buster Collier.

Charles G. Clarke, A.S.C., is shooting "The Motor Maniac," starring Red Grange at the F.B.O. studios. Sam Wood is directing from an original story by Byron Morgan, who is remembered as the author of the Saturday Evening Post automobile racing stories which served as starring vehicles for Wallace Reid. This is the same director-author-star-cinematographer combination which made the successful "One Minute to Play"—Grange's debut into motion pictures.

* * *

Norbert Brodin, A.S.C., is filming "The Clown," a Columbia production.

George Barnes, A.S.C., is chief cinematographer on the Samuel Goldwyn production, "King Harlequin." Ronald Colman and Vilmy Banky are co-starred.

* * *

Charles Rosher, A.S.C., has concluded the cinematography on "Sunrise," F. W. Murnau's first American directorial effort. Critics who saw the preview of the Fox production featured the photography of Rosher in their reviews.

Charles Van Enger, A.S.C., is filming the First National production, "Diamonds in the Rough," starring Milton Sills with a cast numbering Natli Barr, Charles Gerrard, Edward Peil and John Miljan. Charles Brabin is directing, with Ray Rockett in charge of the production management.

* * *

Frank B. Good, A.S.C., has completed shooting of "The Bugle Call," starring Jackie Coogan at the Metro Goldwyn-Mayer studios.

* * *

Gilbert Warrenton, A.S.C., will leave shortly on a location-hunting trip preparatory to the filming of Universal's "Lea Lyon," on which, starring Conrad Veidt, the A.S.C. member will be chief cinematographer.

* * *

ReginaldLyons, A.S.C., has finished the cinematography on "The Holy Terror," a William Fox production starring Buck Jones.

* * *

Harry Perry and Paul P. Perry, both A.S.C. members, are photographing studio sequences of "Wings," on which the former is chief cinematographer.

E. Burton Steene, A.S.C., is still occupied with Akeley sequences on the production.

* * *

Edward J. Snyder, A.S.C., is making preparations for the filming of the next Pathe serial to star Walter Miller and Allene Ray.

* * *

Charles Stumar, A.S.C., is still busy with the cinematography on Universal's production of "Uncle Tom's Cabin," which Harry Pollard is directing.

A.S.C. Closes Banner Year

Coming Fiscal Year *to* Be Bigger *than* Past, However, Says Chief *of* Cinematographers

(The following interview, written by the editor of this publication appears in a current number of EXHIBITORS HERALD*).*

At the close of what probably has been the most successful year in the history of the American Society of Cinematographers, Daniel B. Clark, president of the A.S.C., predicts an even more eventful period for the cinematographic branch of the industry in the twelve months that are to come. The A.S.C. fiscal year of 1927-28 begins during the first week in April.

"The photographic side of the motion picture business," Clark states, "has made monumental strides during the twelve months that is coming to a close. We have seen the advent and general acceptance of new film products and practices such as panchromatic film, faster lenses, more expressive camera effects and so on. Anticipating and encouraging these progressive steps has been the American Society of Cinematographers, so that when the time came for their adoption into practical production, every A.S.C. member had been theoretically and practically grounded in their use and application—all of which has meant a saving of thousands of dollars to producers in needless experimentation and the attendant waste.

Future Is Greater

"But as great," the A.S.C. president continued, "as the achievements indicated in the foregoing have been, they merely stand as the foundation for newer and greater accomplishments that are to be brought about during the coming fiscal year of the A.S.C. It is the policy of this Society to look ahead for and to anticipate the improvements in the cinematographic phases of the art, and when the time is ripe for the introduction of such improvements it is our policy to be ready to deal with them in the most efficient manner possible.

Have No Peers

"That the thoroughness of the American cinematographer is appreciated more than ever before is shown in some measure in an interview with Jesse L. Lasky appearing in a current issue of a national fan publication. The gist of the interview is that while dozens of foreign directors and artists have been brought to this country to inject new ideas into film productions, no such importation of cinematographers, who worked with these people, has been made. The answer is that the pre-eminence of American cinematographers generally is inapproachable, and that nothing which the most complex European directorial mind could want visualized cinematographically is beyond the ken of our camera artists. We were more than glad to see the producers recognize this fact. And I say all of this with the utmost respect for the photographic efforts of the cinematographers across the Atlantic. Following the unproductive period during and immediately after the war, the results which they have been able to attain can only be a subject for admiration.

"Some idea," Clark concluded, "of what the coming seasons will bring in cinematography may be gained from 'Sunrise,' directed by the eminent German director, F. W. Murnau, when it is released. Charles Rosher, a member of the A.S.C., was chief cinematographer on the feature, and those who have seen the preview state that, photographically it is Rosher's masterpiece to date—and that means a great deal to those who are familiar with cinematographic history!"

Martin J. Quigley Addresses Cinematographers *at* Meeting

Martin J. Quigley, editor and publisher of *Exhibitors Herald*, was the guest of honor and principle speaker at the open meeting of the American Society of Cinematographers, held in the A.S.C. assembly rooms, Monday night, February 28th.

Quigley emphasized the importance of cinematographic and scientific progress in the motion picture industry, praising the A S.C. for the prominent part it has played therein. He pledged the support of himself and of his publications to the A.S.C. program for aiding in continuing such progress. Quigley was accompanied at the meeting by Ray Murray, manager of the West Coast offices of *Exhibitors Herald*, and by Harry Nichols, special representative of that publication.

Following Quigley's talk, Gustav Brock, of New York City, exhibited a sample reel of colored photography.

Panchromatic Motion Picture Film Negative

Second Number of Series Based on Communication of Eastman Research Laboratories.

By Loyd A. Jones, and J. I. Crabtree

Consider Spectral Composition of Radiation from Different Light Sources.

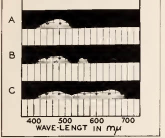

Figure 3

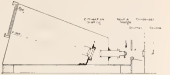

Figure 4

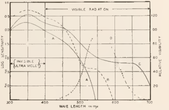

Figure 5

(Continued from last month)

AS STATED in the introduction, photographic materials vary enormously in their sensitivity to radiation of different wave-lengths. In Fig. 3 are reproduced three spectrograms which show qualitatively the spectral sensitivity for three typical classes of photographic materials. These spectrograms are obtained by use of small spectrograph designed especially to test the color sensitivity of photographic materials. A source is imaged on the slit of the instrument by means of a condenser lens. The dispersing element is a diffraction grating, thus giving a normal spectrum, that is one in which equal wave-length intervals are represented by equal intervals on the photographic plate.

Ruled Scale Plate

The plate holder is provided with a ruled scale plate so that a scale of wave-lengths is automatically impressed upon a photographic plate when the exposure is made. A wedge of neutral gray glass is placed over the slit of the instrument so that the exposure incident on the photographic materials being tested decreases across the spectrum. In this way an indication of the variation in sensitivity throughout the spectrum is automatically obtained. The light source used is an unscreened acetylene flame. Since the amount of energy radiated by the acetylene flame at different wave-lengths is not constant but increases rapidly with increasing wave-length (see Fig. 8) it is evident that the curve obtained by outlining the light portion of these spectrograms is not the true spectral sensitivity curve for the material but the resultant obtained by compounding the spectral distribution of energy for the source with the spectral sensitivity of the photographic materials.

However, since the same light is used for all three materials they do show relative color sensitivity. It will be noted in case of the ordinary non-color sensitive material (A, Fig. 3) that the sensitivity becomes practically zero at 530 mu. It follows therefore that any object reflecting radiation of wave-length longer than this value no matter how bright it may appear visually will be rendered as a very dark or black object by such materials. The band or green sensitivity conferred by the sensitizer used in making the orthochromatic material, (B, Fig. 3) has a maximum at 560 mu and ends at approximately 580 mu. It is evident therefore that this material since it responds to green light will reproduce green objects more nearly in their true position on the visual tone scale In case of the panchromatic material (C, Fig. 3), however, the sensitivity extends beyond 700 mu. the limit of the visible spectrum. This material is sensitive therefore to all wave-lengths of radiation which produce the visual sensation of light and it is only by the use of material such as this that a scene containing colored objects can be rendered in correct visual tone value.

Selective Absorption

The apparent decrease of sensitivity of all of these materials on the short wave-length side of 480 mu. is due

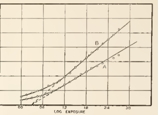

Figure 6

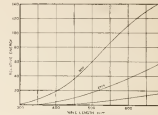

Figure 8

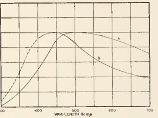

Figure 7

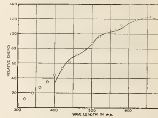

Figure 9

to the selective absorption in the gray glass wedge used over the slit of the spectrograph. Actually this sensitivity does not decrease but rather increases in all cases, at least to 350 mu. Since the glass used in making photographic objectives absorbs practically all radiation less than 350 mu. it is not important from the standpoint of motion picture work to know the wave-length sensitivity relation beyond this point.

For Quantitative Purposes

While spectrograms such as are shown in Fig. 3 are useful in judging relative sensitivity they are not satisfactory for quantitative purposes. For such requirements a curve showing the relation between sensitivity, defined in some suitable terms, and wave-length of radiation is necessary. Unfortunately satisfactory data relative to materials used in motion picture work are not at present available. Work on these materials is in progress at present and it is hoped to be able to publish precise data of this nature in the near future. Some data, in the reliability of which we feel great confidence, relative to materials of very similiar spectral sensitivity are, however, available and in Fig. 5 they are given in graphic form. The measurements were made with great care using a monochromatic sensitometer[2] especially designed for this purpose.

Sensitometric Method

The sensitometric method of measuring the characteristics of the photographic material is illustrated hy the curves shown in Fig. 6. The samples of the material to be tested are exposed in a sensitometer which is an instrument designed to impress on different areas of the material exposures of different magnitudes. It is customary to use a series of exposures increasing according to a logarithmic scale (1, 2, 4, 8, 16, etc.). Upon the development this exposed strip yields a series of silver deposits differing in density. The density, that is the light absorbing power, of the various deposits are then determined measuring the amount of light transmitted by them. If the intensity of the light incident upon such a deposit be represented by I_0 and the intensity of that transmitted by the deposit by I_1 then:

T (transmission) $=I_1/I_0$
O (opacity) $=I/T=I_0/I_1$
D (density) $=\log o=\log I/T$.

The characteristic curve of the material (illustrated by the curves in Fig. 6) is obtained by plotting density as ordinates against the logarithms of the corresponding exposures. If the series of exposures given in the sensitometer be of the logarithmic type then the logarithms of these numbers fall at equally spaced intervals on the X axis.

A curve connecting the points thus established gives the relation between density and log exposure for the particular time of development used in developing the test strip. These curves in Fig. 6 were obtained on Eastman Panchromatic Negative Film. Development was carried out in MQ 80 at a temperature of 20°C, curve A being developed for 4 minutes and curve *B* for 8 minutes. It will be noted that a large portion of these curves are represented to within the limits of experimental error by

2 Jones L. A. and Sandvik Otto. Spectral Distribution of Sensitivity of photographic materials. J. O. S. A. 12 Apr. 1926 P. 401

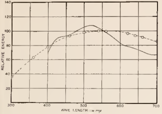

Figure 10

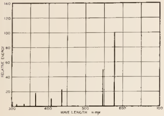

Figure 12

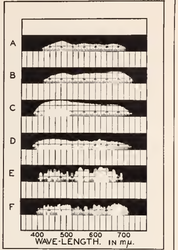

Figure 11

straight lines. The angle which the straight line makes with the log Exp. axis depends upon the time of development as shown by the curves. It is evident that any given exposure may result in a density of variable magnitude depending upon the time of development. In specifying the sensitivity of the material it is not satisfactory therefore to express this in terms of a density produced by a given exposure without defining the extent to which development is carried. It is customary to specify the speed or sensitivity of a photographic material in terms of the exposure value at the point where the straight line portion of the curve extended cuts the long Exp. axis. It has been found in the case of many photographic materials when developed in solutions containing relatively small amounts of bromide, that this exposure value(which is termed the inertia) is independent of the extent of development. The inertia value therefore is in these cases independent of development and serves very satisfactorily as a means of specifying sensitivity. Since the value of inertia decreases as the speed of the material increases it is necessary to define sensitivity as the reciprocal of the inertia. In practical sensitometry it is desirable to specify the sensitivity of a material in terms of exposure expressed in visual unity. The sensitometric exposures are therefore defined in terms of visual candle meter seconds of light of some definite reproducible spectral composition. The most suitable standard of light quality for sensitometric purposes is noon sunlight.

Absolute Energy Units

Due to the difficulties involved in measuring the brilliance factor of the sensation excited by the action of a monochromatic radiation on the retina, it is more satisfactory for the purposes of specifying the spectral sensitivity of a photographic material to express the exposure in terms of absolute energy units. In the monochromatic sensitometer referred to, the material under test is exposed to extremely narrow wave-length bands of radiation. By means of a suitable energy measuring device such as the thermopile the energy incident on the plate is determined. Exposure may be expressed therefore in terms of ergs per sq. cm. It has been found that the slope of the characteristic curves obtained with a fixed time of development depends upon the wave-length of the radiation to which the photographic material was exposed. Hence if the sensitivity for different wave-lengths of radiation be experssed in terms of the inertia, that is the exposure value at which the straight line extended cuts the log Exp axis, the result obtained is not a true indication of the relative density producing power of the different wave-lengths. In order to eliminate this objection it is necessary therefore to develop the strips exposed at various wave-lengths for different times so as to obtain characteristic curves of the same slope. If now the exposure be determined at which each wave-length gives a fixed density (such as D=1.0) a satisfactory specification of spectral sensitivity is ob-

(Continued on Page 21)

Suggests Unique Crediting Method

Cinematographers Should Sign Print *at* Start *or* Finish, Says T. O. Service

Under the heading, "It's Time Cameramen Were Signing Their Stuff," T. O. Service, in the current studio section of Exhibitors Herald, advances a novel suggestion for accrediting cinematographers in productions which they photograph. Service illustrates his idea with two stills. However, his article is self-explanatory, and reads in part as follows:

It is some time since I have written anything for this section of the HERALD—which is another way of saying it is some time since I have had anything of seeming importance to say to the residents of Hollywood—but I believe that at least one of the several suggestions I am about to offer without charge or assessment of any character is worthy of the space it will occupy and the minute or two of your time required to read it. Therefore I shall place that suggestion first and shall address it principally to the American Society of Cinematographers.

I have watched with considerable interest the campaign of this organization to obtain for cameramen a proper recognition, a recognition effected by suitable identification of each individual with the work that he does. As I have heard of no violent opposition to this campaign from anyone with a defensible basis for the same, I conclude that the real reason for lack of such recognition is lack of a practical and standardized means of making the identification desired. I believe I am about to describe such a means.

Should Sign Closing Scene

The commercial photographer, the maker of portraits, assures himself of proper credit by signing his work in white in the lower right or left hand corner of the portrait. My suggestion is that motion picture photographers do likewise, signing their pictures as the artist signs his canvas. I believe such a signature should appear on the closing scene of the production, where it will be seen after the cinematographer's work has been viewed and the viewer can form a definite opinion of his work. It might appear, otherwise, upon the first scene of the picture or upon the main title, in the latter case the white signature being faded in and brought up to white as the main title is darkened out. It has been my experience, however, that identities learnd after the picture has been seen are remembered much better than those learned (rather scanned) before.

To clarify this suggestion, the art department has reproduced two stills from "The Last Trail," a Fox picture starring Tom Mix, upon which has been written the name of Daniel B. Clark, the cinematographer, in the manner it would appear on the screen if this means of identification were in use. One of these stills is supposed to be the opening scene, the other the closing one. If the signature were used on the opening scene, it would fade out after a few seconds; if on the closing scene, as I believe best, it would fade in after the clinch had gone to a draw and while the central figures were inactive.

This suggestion is advanced on its merits and I make no further plea for its adoption. Should it become necessary, however, I shall be pleased to refute any and all arguments against it to the satisfaction of whoever may be concerned.

Cowling Writes Article *for* *N. Y. Times* Magazine *on* Kashmir

Herford Tynes Cowling, A.S.C., blossoms forth once more as a big-league author with the article, "A Modern Ruler in the Vale of Kashmir," which appeared in the February 27th edition of the *New York Times Magazine.*

In the article, the A.S.C. member deals with the new regime in the state of Kashmir, where, it will be recalled, he sojourned for many months, first, prior to his expedition into Tibet where he was the first white man to take a motion picture camera and, second, when he returned to Kashmir at the request of Sir Hari Singh to film the coronation of the latter as ruler of the Indian principality. This assignment stands as one of the most unique in film annals, inasmuch as the films which resulted therefrom were intended solely for the private archives of the famous Sir Hari, who paid Cowling a record retainer to execute the commission.

Cowling is now connected with the Eastman Kodak Company, Rochester, N. Y.

Amateur Cinematography

A Professional's Notes *for* Amateurs

Part V
By Jos. A. Dubray, A.S.C.

Cites Discoveries *and* Experiments Revealing Secrets of Colors *of the* Spectrum

IN the explanation of the phenomena of refraction, we have considered only rays of *monochromatic light.* This phenomena is much more complex, if we study the behavior of a pencil of composite light.

To Sir Isaac Newton, we owe the portentous discovery of the composite nature of white light, such as the light of the sun.

By letting a pencil of sunlight be refracted by a glass prism, we notice that, besides the change of direction that the ray suffers according to Snell's Law, the pencil is decomposed in several kinds of light and form on a receiving screen a band of different colors, which most harmoniously blend into each other, forming thus an innumerable variation of tints, out of which, Newton has selected the seven most predominant ones, viz: *Violet, Indigo, Blue, Green, Yellow, Orange and Red.*

The colored band thus obtained is called the *solar spectrum,* and the phenomena itself was given the name of *dispersion.*

Simple

Each and every one of the colors of the spectrum, if isolated and forced to pass through a glass prism, follows the law of refraction, but *is not decomposed into any other kind of light,* from which fact, the conclusion is reached that the colors of the spectrum are *simple.*

Furthermore, if all the colors of the spectra are reflected with the aid of mirrors so as to force them to meet at a certain one point, *white light* is obtained, this experiment proving conclusively the composite nature of white light.

Sunlight

Now, let us consider a pencil sunlight, traveling towards the earth, at the original speed of 186.000 miles per second.

All the colored rays forming this beam of light will travel in a straight line, from their origin, until they reach the earth's atmosphere.

In entering the medium *air,* they will be refracted and this refraction will be gradually more pronounced the closer they come to the earth surface, because of the gradual increase of the density of the medium *air,* from its upper to its lower layers.

Apparently, the density of *air,* even at its maximum, does not produce sufficient dispersion to be noticeable, but, if we permit this pencil of sunlight to enter a denser medium, such as a glass prism, the velocity of each colored ray suffers a retardation, which is more pronounced, the smaller is the wavelength of the ray.

This difference of retardation creates, at the surface of the incident surface of the prism, an infinite number of disturbances, each corresponding to a ray of a particular color. Each colored ray, is thus refracted by the medium of the prism, following a certain direction according to its wave-length, thus departing from the other rays of different wave-length.

Refracting Index

In other words each one of the colored rays forming the pencil of white light, possesses its own refracting index, the *violet* being the most, and the *red* the less refrangible rays.

These different colored rays travel then within the prism, each following a straight line, but a different direction, the *violet* being deflected towards the *base* of the prism, more than the *red.*

At the surface of emergence, the rays are again refracted into the less denser medium *air* creating as many points of disturbance as there are rays and as these points of disturbance are definitely separated from each other, they emerge according to their new position, and when collected on a screen, they form the colored band called *spectrum.*

Mixing Colors

IT is evident that the different colors forming the Spectrum, can be collected separately, and mixed, by pairs, independently to the position they occupy in the spectrum.

It has been found that *white* can always be obtained by mixing *two* of the *spectral colors*

(Continued on Page 16)

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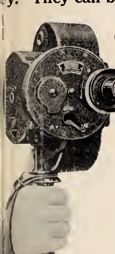

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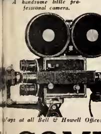

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Amateur Cinematography

(Continued from Page 11)

and two such colors that give *white*, are called *complementary* to each other.

Thus: *red and greenish blue* are complementary as *blue* and *yellow*, *orange* and *deep blue* (Prussian Blue), *greenish yellow* and *violet*, etc.

It must be borne in mind that, in mixing *spectral colors*, we add one tint to another. The case is entirely different when mixing *pigmentary colors*.

A substance appears of a certain color, because it *absorbs* a portion of the colored rays, and transmits or reflects the remainder. Suppose, for instance, a yellow substance. This particular substance appears yellow to the eye because it absorbs all of the red rays, partially the orange, partially the greens, and *all* of the *blues*, *indigo* and *violet*. The predominant rays that it transmits or reflect being yellow, the substance appears of this color and of such graduation that corresponds to the amount of other colors that it transmits or reflect in less quantity. Similarly, a substance will appear *blue* if it absorbs *all* of the *yellow* and *red* and *violet*.

Now if we mix a yellow substance and a blue one, each will absorb the predominant color of the other, and the result will be a *substraction* of rays, the ones being finally transmitted or reflected being the colors only partially transmitted or reflected by both substances before the mixture.

Thus:

Pigmentary—*Blue* and *yellow* form *green* by *substraction* of colored light.

Spectral—*Blue* and *yellow* form *white*, by *addition* of colored light.

Science of Spectroscopy

NEWTON'S great discovery led the way to a thorough study of the Solar Spectrum, and to Fraunhofer, is due the greatest advance in the Science of Spectroscopy.

Fraunhofer

Fraunhofer improved greatly Newton's apparatus by collecting the sun rays through a narrow slit in the wall of a dark chamber and by placing a convergent lens between the slit and the prism. He thus obtained a spectrum of great clarity and definition.

In the course of his studies, Fraunhofer discovered that the solar spectrum, is not *con-*

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tinuous, but intermingled by *black lines* and that the position of these lines is always the same, even if the refracting medium of which the prism is made is different.

Through patient and savant investigation, Fraunhofer discovered the existence of over *seven hundred* such lines and named the *eight* most decidedly marked ones, by the letters of th alphabet A, B, C, D, E, F, G, H; the line A being the line found in the red portion of the spectrum; the line H, the one found in the violet; and the other lines belonging to the intermediate spectral colors.

Kirchoff

Although Fraunhofer devoted considerable and fruitful work to the study of the spectral lines, their real significance was discovered by Kirchoff. This eminent physicist, while experimenting with the brilliant monochromatic yellow light produced by burning sodium in a colorless flame, permitted the white light originated by incandescent lime to pass through the yellow sodium light.

He produced thus a spectrum in which a dark line corresponding to the D line of the solar spectrum was plainly visible.

Completing his experiment, Kirchoff found that this dark line corresponded exactly to the *bright* line formed by the sodium flame, and the conclusion of this remarkable fact is that *the vapor of any element has the power of absorbing rays of the same refrangibility as that which it emits; and the ratio between the powers of absorption and emission, is constant.*

The constancy of this ratio permitted Kirchoff to detect the presence of an element even in the most minute quantities.

One two hundred millionth of a grain of sodium is sufficient to provoke the appearance of the D line in the spectrum.

This phenomena is not confined to the sodium flame alone. All elements when volatilized by a non-luminous flame produce a *bright* line in a certain region of the spectrum and if the white light of glowing lime is allowed to pass through the light of the element, a *dark* line takes the place of the bright one.

The co-incidence of such lines permitted Kirchoff to emit a theory of the constitution of the Sun.

Kirchoff's work gave great impulse to the science of spectroscopic analysis, through which several elements have been discovered such as Rubidium, Coesium, Thallium, Indium, Gallium and the new gases Argon, Helium, Kripton, Neon and Xenon.

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Ignited liquids also give a continuous spectrum, while gases, give a *discontinuous* one.

This phase of his work, which has proven light emitted by the incandescent gases that constitute the envelope of the Sun.

If the slit of the spectroscope is illuminated by *white light*, such as the light of the Sun, or such light as those produced by incandescent magnesium or lime or acetylene, etc., and a colored glass or liquid is placed between the slit and the prism, and absorption spectrum is obtained, so called because it is the spectrum given only by the lights not absorbed from the white light by the colored glass of liquid.

Wave-Length of Lights

AFTER he had amplified and improved Newton's experiments, Fraunhofer devoted himself, as a natural sequence to his work, to the measurement of the wave-length of the different lights composing the spectrum.

This prase of his work, which has proven of tremendous importance, is related to investigations and experiment previously made by other scientists, namely by Grimaldi, first, and Fresnel and Young, later.

Diffraction

Grimaldi was the first to notice and name a phenomena of light, called *diffraction*. Fresnel and Young explained it, through the principle of *interference*.

If two sources of monochromatic light are produced at a very small distance from each other, and their rays are made to meet each other under a very narrow angle, a *discontinuous* patch of light may be seen on a screen placed a little beyond the point of meeting. If one of the sources of light is extinguished, the other source will illuminate the screen homogeneously, but when the two lights are permitted to function, there appear a series of dark bands of fringes, very well defined.

Grimaldi, who first noticed this phenomena, drew the conclusion that light, added to light, produces darkness. It was only when Fresnel and Young undertook to explain this phenomenon that its full importance was recognized.

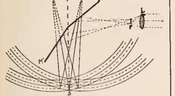

Figure 14

Fresnel's Experiment

Fresnel permitted a beam of sunlight to enter a dark room through a narrow slit and rendered this beam monochromatic by forcing it through a plate of red glass.

With the aid of a cylindrical lens L, he reduced the pencil of light into a narrow line at F of the figure.

The two mirrors M and M', placed at a very obtuse angle, both reflect the light of the line F as if proceeding from two distinct sources f and f'. (For the sake of clearness, the figure exaggerates the distances between these two points).

The points f and ' become thus centers of disturbance, and the rays they emit meet thus under an extremely small angle.

The wave fronts produced according to the undulatory theory of light meet then as illustrated. Let each one of the fully drawn arcs be at one wave-length from the next, and the dotted arcs mark half of a wave-length.

If a screen is placed at S, perpendicular to S S', it will be noticed that *light* will appear wherever two full arcs meet, while a dark fringe will happen wherever a full arc meets a dotted one. In other words, the lights emitted by the two sources f and f' will *interfere* with each other and extinguish each other wherever the distance from f and f' differ by half a wave-length.

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Wherever the full lines meet, there is a coincidence of phases and the two lights, strengthen each other, but wherever a full line is crossed by a dotted one, their phases differ by half a wave-length; they neutralize each other and darkness is the result.

Any other monochromatic light besides red will give the same phenomenon, *but the distance between the lines will differ, according to the wave-length of the light.*

It results that if *white light* is used, as white light is formed by the mixture of colored lights of different wave-length, the bright area of one color will overlap the dark area of another and instead of dark fringes, a succession of colored bands will be formed.

It is evident that if the distance between two dark fringes, separated by a bright line and the sources of light f and f′ can be measured, it will be possible to determine the length of the wave of the monochromatic light submitted to *interference*.

Young and Fresnel were lead to investigations that resulted in the remarkable theory of *interferenc*, by another phenomenon noticed by Grimaldi and called *diffraction* of light.

Grimaldi noticed that if a pencil monochromatic light admitted into a dark chamber and collected on a screen is partially intercepted by a very sharp edged instrument such as a razor blade, part of the light seem to bend into the geometrical shadow produced by the edge and above it, where the illumination of the screen should apparently be homogenous, dark band or fringes make their appearance very distinct at the margin of the shadow, and gradually diminishing in distinctness until they finally disappear.

As in the phenomenon of interference, if *white light* is thus intercepted, colored bands will take the place of the dark lines.

Diffraction and interference occur then; th first actual bending of rays occur, while the second takes place through the action of two rays of light, meeting each other under certain specified conditions.

Fraunhofer applied the phenomena of diffraction in his investigation of the spectrum and succeeded in obtaining remarkably accurate measurements of the length of the light-waves.

(To be Continued Next Month)

PANCHROMATIC NEGATIVE

(Continued from Page 11)

tained. The sensitivity values as shown by the curve in Fig. 5 are defined in this manner, sensitivity being the reciprocal of the energy (expressed in ergs per unit area) which is required to produce a density of unity (D=1.0) when the slope of the characteristic curves for the various wave-lengths is also unity.

Curve *A* is for Eastman 33 plates which is typical of the medium speed non-color sensitive class of materials. Curve *C* is for Wratten and Wainwright panchromatic plates. A comparison of a wedge spectrogram made on this material with one made on panchromatic motion picture film indicated that the two are practically identical as regards color sensitivity. Very little error will be involved in assuming that curve C defines the color sensitivity of panchromatic motion picture film. Curve *B* is estimated by comparing a wedge spectrograph made on Par Speed motion picture negative film with one made on Eastman D. C. Ortho plate for which precise data are available. This curve may be subject to some error but it is probably sufficiently precise for all practical purposes.

Light Sources

THE spectral composition of the radiation emitted by different light sources used in motion picture work varies enormously. These sources may for convenience be divided into two classes, (a) those having a continuous spectrum and (b) those having a discontinuous or line spectrum. Of the former the incandescent lamp is typical and of the latter the Cooper Hewit mercury vapor lamp is a well known example. As stated previously it is customary to show graphically the date relating to the spectral composition of radiation. These curves (spectral energy distribution curves) are obtained by plotting energy as a function of wave-length. Since in the discussion of the rendition of colored objects by means of photographic materials of different color sensitivity a knowledge of the spectral quality of the illuminating radiation is necessary, data relative to some of the sources commonly used in motion picture work will be given.

Black Body

If a completely closed cavity be raised to a high temperature the spectral composition of the radiation emerging from the cavity through an aperture which is small relative to the size of the cavity follows a definite fundamental law and the spectral distribution of energy in this radiation can be computed precisely. Such a source is commonly referred to as a *black body* or a *complete radiator*. While this source is not of practical importance for illuminating purposes it serves as a very useful standard in terms of which to express the spectral composition of certain sources of practical importance. For instance it has been found that the color of light emitted by a heated tungsten filament is the same as that emitted by a black body at some definite temperature. The black body temperature at which the colder match occurs is designated as the *color temperature* of the tungsten filament and it is quite customary to specify the quality of

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light emitted by a tungsten lamp and the efficiency at which this lamp is operating in terms of its *color temperature*. The radiation from a *black body* at a temperature of 5400°C has been found to match in color that of noon sunlight. Hence the black body serves also as a useful standard for establishing precisely a definite standard of white. The spectrum of black body radiation is continuous and can be satisfactorily defined by a smooth curve the ordinates of which are energy and the abscissae wavelengths. In describing the sources in motion picture studios it frequently will be found convenient to describe qualitatively at least the composition of the emitted radiation in terms of its color temperature.

Sunlight

The spectrum of sunlight is of the continuous type crossed by many fine dark lines, Fraunhofer lines These lines have little influence upon the distribution of energy in radiation from the sun and for all practical purposes the spectral distribution may be represented by a smooth curve, curve *A*. Fig. 7. The maximum occurs at wavelength 510 mu. The rapid decrease in energy between 400 and 300 mu. is due to absorption in the earth's atmosphere.

Skylight

Consists of radiation from the sun which has been scattered in various ways by the earth's atmosphere, air, dust, water vapor, etc. It is distinctly blue in color. The distribution of energy in light from a clear north sky is shown in curve B Fig. 7.

Incandescent Tungsten

While this source is used but little at present since it is relatively deficient in radiations of wave-lengths to which the par and superspeed motion picture negative film is most sensitive (350 to 550 mu.) it is probable that with the increasing use of panchromatic film it will become more widely used. The relatively large proportion of energy radiation in the region of longer wave-lengths (500 to 700 mu.) to which panchromatic film is sensitive makes it especially valuable for use with this material. In Fig. 8 are given three spectral energy distribution curves for tungsten. Curve *A* applies to the modern high efficiency high wattage gas filled lamps used in motion picture studios. Curve *B* is for a gas filled lamp operated at medium efficiency. Curve *C* shows the distribution of energy in the spectrum of a vacuum type lamp. These curves illustrate the way in which the energy radiated at any wave-length increases as the operating temperature is raised. Lamps of the type represented by curve *A* are now available in sizes from 1 to 30 KW. Of these the 3 and 10 KW. units have proved most practical in motion picture studio work[3], the 3 KW. unit for general lighting and the 10 KW. mounted in front of a parabolic reflector for spotting purposes. These lamps offer many advantages for studio use among which may be mentioned cleanliness, freedom from objectionable fumes, ease of manipulation, and the fact that when they have once been placed in position the attention of an operator is not needed. One man at the switch board can control all lamps on one or even several sets.

Carbon Arc—D. C., Hard Cored Carbons

The great preponderance of energy in the radiation from this source comes from the positive crater which is at a color temperature of approximately 4000°C. The spectral distribution of energy is of the continuous type and is practically identical with that of a black body at 4000°. The spectrum of the radiation from the arc stream is of the line or band type but the total energy due to this radiation is negligible in comparison with that from the crater. The distribution of energy is shown by curve *A* in Fig. .9

The High Intensity Arc—Sun Arcs

The carbons used consist of an extremely hard shell of carbon inside of which is a softer core impregnated with the fluorides of cerium thorium. The spectrum of this source consists of a relatively low intensity continuous background due to radiation from the carbon walls on which is superposed a large number of bright lines due to the core material. These lines are so numerous that for all practical purposes the spectrum is continuous. The color of the radiation emitted by the sources as a whole matches fairly well that emitted by a black body at 5400°K. Noon sunlight also matches in color quite closely the radiation from a black body at this temperature. It will be seen therefore that the light emitted by this light source is very near to our standard of white. In Fig. 10 the solid curve shows the spectral distribution of energy emitted by the high intensity arc as determined by Benford[4]. The points designated by small circles show the distribution of energy in the radiation emitted by a black body at 5400° abs. It will be seen that the distribution of energy in the radiation from the arc is not identical with that from the black body at the temperature mentioned. The color match which exists is therefore only subjective.

Flame Arcs

The carbon used in these arcs have cores which have been impregnated with various metallic solids. The spectrum consists of a large number of bright lines, due to the volatilization at high temperatures of these metallic salts, superposed on a continuous spectrum due to the incandescence of carbons. It is practically impossible to show the spectral distribution of energy by a curve on account of the presence of these numerous lines of variable width and intensity. Carbons of many different types are available on the market giving white, yellow, red, and blue flame arcs. The white and yellow varieties are most commonly used in motion picture work. The spectrograms in Fig. 11 show qualitatively the distribution of energy in several different flame arcs.

Mercury Vapor—Cooper Hewitt

The source of radiation is a column of mercury vapor enclosed in a glass tube. This vapor is excited by the passage through it of an electrical current which causes it to emit radiation at certain wave-lengths. Obviously such discontinuous radiation can not be represented by a continuous curve. The heavy vertical lines in Fig. 12 show the wave-lengths at which emission occurs. The height of each line is proportional to the amount of energy radiated at those wave-lengths.

Mercury Vapor—Quartz Tube

In this source the mercury vapor is enclosed in a tube of fused quartz which due to its heat resisting properties permits the use of a higher operating temperature and gas pressure than can be used in case of the glass tube. This results in a marked enhancement in the amount of energy

[3] Jones L A Incandescent Tungsten Lamp Installation for Illuminating Color Motion Picture Studio Trans S M P E, No 22, 1925 P 25.

[4] Benford, Frank The High Intensity Arc Trans S M P E, No 24, 1925, P. 71

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Illustration is a single frame from a film made by Carol Fennyvessy, Rochester, the closing event of the Rochester Horse Show. Taken at dusk, in a pouring rain, at 10 minutes to 6 P.M., September 12.

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radiated at certain wave-lengths. Furthermore since quartz is very transparent to all wave-lengths down to 180 mu. (ordinary glass absorbs all radiation of wave-length shorter than 350 mu.) a large amount of ultraviolet radiation is emitted. While this radiation is very active photographically and the source is useful for certain photographic purposes it is of little value in the motion picture studio. Very few natural objects reflect ultraviolet radiation. Moreover the glass lens used in the camera does not transmit radiation of wave-length less than 350 mu. It is possible of course to make lenses of quartz which do transmit this radiation but its use is of doubtful value since it would certainly produce a further departure from correct visual tone reproduction. It has been proved conclusively that radiation of wave-length shorter than 305 mu. is highly injurious to the eye. It is necessary therefore to enclose these quartz lamps in glass globes which absorb this injurious radiation. All things being considered, it does not appear that this source is suitable for studio use and so far as the authors know it is not used at present to any great extent.

(To be Continued Next Month)

Pete Harrod Resigns *from* Paramount *to* Join Creco, Inc.

Pete Harrod, well known Hollywood electrical expert, has resigned as head of the electrical department at the Famous Players-Lasky studios, Hollywood, to become associated with Creco, Inc., in an executive and advisory capacity.

Harrod is one of the best known and most popular members in studio illuminating engineers circles, and has supervised the electrical arrangements for countless large productions made at the Paramount plant. He is a pioneer in the business.

Geo. A. Blair *and* Eastman Workers Return *to* Rochester

George A. Blair, motion picture film sales manager for the Eastman Kodak Company, has returned to Rochester from his recent trip to Hollywood.

Blair was preceded in his return to Rochester by J. I. Crabtree and Dr. K. A. Hickman, who left shortly after they had completed their lectures on panchromatic and kindred subjects before Hollywood cinematographers and laboratory officials.

"TALKING PICTURES"

(Continued from Page 5)

done. But it is a far cry before it can be done commercially effective. If it is thought that the small-town audience will be less discriminating, it might be remembered that the efficacy of the "black and white" motion picture will preclude such an uncritical mood. The exhibition must be just as "slick" for the hinterland as it is for Broadway. We do not think, either, that the exhibitor at this time is ready to accept the talking picture generally. We believe that he regards it as something of a curiosity which is practically removed from his ken of things. The problem of those organizations which are interested in the talking film resolves itself to one of exploitation. Not only the exhibitor must be made to want the human voice with his films, but the public at large must be educated to the point where it demands it or will accept it fifty-two weeks in the year.

¶ Meanwhile, we wish all prosperity to those who are behind this type of motion picture, and we do hope that their efforts will be sufficiently rewarded so as to make it worth-while enough for them to continue their experiments and research.

John Ford Made President of Directors Association

John Ford has been elected president of the Motion Picture Directors Association, Hollywood, for the coming year.

Other officers elected include Albert Rogell, vice president, and Reeves Eason, treasurer. The board of directors numbers William Beaudine, George Irving, Phil Rosen, Reginald Barker, Norval MacGregor and Roy Clements. Barker is the retiring president of the M.P.D.A.

Panchromatic (color-sensitive) film is being used by Tony Gaudio, A. S. C., in "shooting" First National's "Three In Love," originally entitled "Here Y' Are Brother," now in production under Al Rockett's management.

It's done partly because of superior artistic effects that may be attained, and partly because Billie, who is co-featured with Lewis Stone and Lloyd Hughes in the picture, is the real "rainbow girl" of the movies.

Billie has beautiful eyes on any sort of film. But it happens that she has two separate screen personalities, depending on whether black-and-white or color photography is used, according to George Landy of the First National publicity department.

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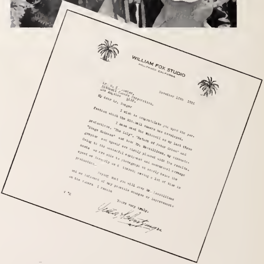

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